HOW TO KEEP WARM

By GERRY CUNNINGHAM

If your feet are cold, put your hat on. That may sound facetious; but to those who understand how the human body works in a cold environment, it is a simple statement of fact.

Man is essentially a tropical animal. He is able to survive and enjoy life in cold climates, where he is also more efficient and productive, only because his ingenuity allows him to maintain his body temperature within the very narrow limits dictated by his physiology. The viable temperature limits are actually about 75°F to 100°F for deep body temperature, but nature has provided us with a comfort threshold well within these limits. Since the purpose of this booklet is comfort, not survival, we will concern ourselves with keeping comfortable and touch on only enough theory to give a background for the practical suggestions offered (see page 9 if you want to skip the theory). It is important to realize that you are interested in your own comfort not in tables of averages as we are forced to use here. Since there is a very wide difference in how individuals react to cold, the data presented here must be tempered by your own reaction. These suggestions will tell you how to be warmer but not how warm you will be.

Gerry, Division of Outdoor Sports Industries, Inc. Denver, Colorado, USA

Extra copies for group use may be obtained by writing Gerry, Division of Outdoor Sports Industries, Inc., 5450 North Valley Highway, Denver, Colorado 80216.

Heat Production

The human body is continually producing heat through the burning of food and must continually lose this heat if it is to maintain the necessary constant temperature within itself. For short periods of time, it may store a little excess heat in its tissues if it can't get rid of it; or if it is losing heat faster than it is producing it, it can draw on the heat stored in its outer layers, but hour after hour it must maintain a steady state: heat loss must equal heat production.

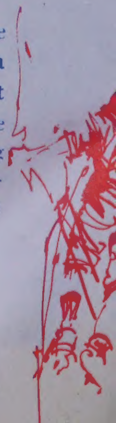
Generally speaking, heat production can be of only two kinds: the body's metabolism (burning of food) and absorption of radiant energy from the sun or other heat source. The metabolic rate is highly variable and is one of the most important warmth factors under your control. It can range for an average man from 70 Calories per hour for sleeping to 524 Calories per hour for strenuous work. One of the most important by-products of metabolism is water. The body produces and loses about 1½ pints a day through the process of continual drying out of the skin (this does not include perspiration). This presents quite a problem which we will discuss in detail later.

The naked body, on a clear day, can absorb as much as 230 Calories per hour of the sun's heat. However, since we are dealing with keeping warm in a cold environment, the body will be well clothed and insulated and the importance of radiation as a heat source in relation to metabolism is greatly reduced. Bright winter sun on snow could account for only about 10% of total heat production unless a good deal of clothing was removed.

Heat Loss—Radiation

To balance the heat intakes explained above, there are five main channels of heat loss. The first three are non-evaporative and have to do with simple loss of heat, calorie for calorie. They are: Radiation, Conduction and Convection and account for about 80% of the total heat loss.

Radiation loss during a winter day amounts to only about 5% of the total loss. At night under a clear sky, the heat loss from the surface of a sleeping bag can be greater. However, in either case, the only heat that can be lost by radiation is that which reaches the outer layer of the clothing or sleeping bag. The higher the temperature of the radiating surface, the faster will be the heat loss. If you have proper convective insulation, the outer layer will remain cool; and thus, there will be little heat lost by radiation.



Conduction

Conduction plays a very small part in total heat loss under most conditions. However, there are several common situations where conduction can be the crux of the discomfort. The soles of the feet are an ever present problem in conduction of heat. Some others are: touching ski bindings or metal camera parts with bare hands; lying on the cold snow or ground in a down filled sleeping bag which compresses to nothing and leaves your body pressure points in intimate contact with a cold surface; sitting on a metal chairlift seat. In each case the conduction due to the intimate contact will be a cause of local discomfort. Since heat flow is from hot objects to cold objects and since the greater the temperature difference the faster the flow, the only way to prevent conduction is to separate your body from the cold object by a low-conductive layer.

A non-conductive material is one which when heated on one side will stay cool on the other. The best material we know of today, as far as clothing is concerned, is air. The trouble with air is that it circulates. When the air right next to a warm body absorbs a little heat, it expands and rises and immediately new cooler air moves in to take its place. This is natural convection. Induced convection takes place with wind action and the bellows action in clothing when you move about. In any case, our poor conductor, air, becomes a good heat transfer agent because of its mobility. To utilize the poor conductivity of air, we must prevent it from circulating.

Convection

How small do we have to chop up the air in order to prevent circulation by convection? Fortunately, the air right next to any surface tends to stick to that surface. This effect extends about 1/8″ out for all practical purposes. Thus, any material that interrupts the path of the air at 1/8″ intervals or less will deaden it so it can be used for insulation.

For clothing and sleeping bag purposes, there is no miracle insulation. They all depend on dead air for the quality of insulation and on thickness for the quantity of insulation. One material is as good as another on a thickness basis. Research done during World War II brought the first confirmation of much of this theory.

For example, a double wool pile fabric was placed between two plates and the temperature drop measured between the plates at various thicknesses of separation. The insulation this fabric provided was found to be proportional to the *thickness* beween the plates in spite of the fact that the same amount of material was used for all thicknesses. In another experiment, cotton, kapok and steel wool (#000) were all tested for insulating qualities when used at a density below 4 lbs. per cubic foot. They all provided the same insulation.

The conclusions were that convective insulation depends on *thickness* of dead air as long as its density is below 4 lbs. per cubic foot. Don't let anyone tell you the latest 1/4" thick "Satelite Foam Jim Dandy Astronaut Jacket" is twice as warm as a 1" thick down insulated jacket. It isn't. It is only 1/4 as warm and the hottest sales pitch won't make it any warmer. If you want warmth, you must have *thickness.*

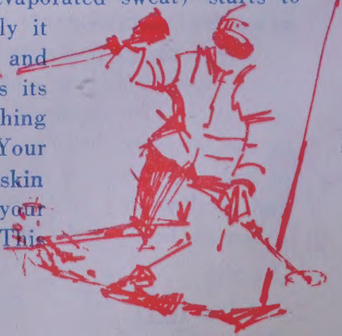
Evaporation

We come now to the last two forms of heat loss, both evaporative. Evaporative heat loss carries away many more calories than the simple heat of the moisture leaving the body. Each gram of water at skin temperature that leaves carries not only the heat required to raise it to that temperature but also the latent heat of vaporization which is about 17 Kilo Calories per ounce.

The two kinds of evaporative heat loss are sweating, which we can indirectly control, and insensible perspiration (the continuous drying out of the skin) plus the vapor lost through the respiratory tract in breathing, which are beyond our control. Even with no sweating, the evaporative loss is 20% of the total heat loss. In a cold environment there should be no need for sweating. Sweating is a means of losing heat from the body when the air temperature is too high for sufficient convective loss, and breathing and insensible perspiration cannot carry the load by themselves.

If the air temperature is cool enough for you to be concerned with keeping warm, then there is plenty of cooling capacity available without resort to sweating. Sweating should be avoided like the plague. Water vapor in the clothing is a problem because it can destroy the convective insulation efficiency. No one needs reminding that wet clothes aren't as warm as dry. A certain amount of vapor is unavoidable, but to compound the trouble by sweating is a cardinal sin when trying to keep warm.

What happens in a typical situation is this: First you sweat and as this evaporates from your skin, you lose both the heat of the moisture, and its latent heat. This gives you immediate relief from the temporary heat stress that triggered the sweating. Unfortunately, you are going to get more relief than you bargained for. This water vapor (the evaporated sweat) starts to migrate through your layers of clothing. Eventually it reaches a layer that is below dew point temperature and it condenses and wets this layer. Here it liberates its latent heat and, because it is close to your outer clothing layer, this heat goes mostly out into the air. Your clothing slowly wicks back the moisture to your skin where the latent heat is once again drawn from your body to evaporate the moisture all over again. This



happens perhaps an hour after the initial heat stress situation and probably during a period when you want most to conserve heat. This cycle continues, each time losing some of the vapor through the natural clothing openings until the clothing eventually dries out. Once started, this constitutes uncon-rolled heat loss. This is why you must prevent sweating at the outset by increasing your convective heat loss.

The Heat Equation

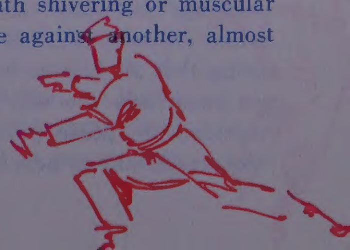
You can think of this steady state of heat production and heat loss as an equation. When the heat loss side is larger than the heat production for any length of time, you are uncomfortably cold. You need to balance the equation. You have an option of doing this in either or both of two ways; increase heat production to balance current heat loss, or cut down the heat loss to match current heat production.

Since your metabolic rate and absorption of radiant heat are the only two factors on the heat production side of the equation, this is the easiest to consider first for the sake of discussion, though often not from a practical standpoint. Obviously, if you are cold in the shade and there is sunshine within reach, you move into the sun. If there is a bonfire handy, you can absorb a little heat there; but that about limits the available increase in radiant heat absorption.

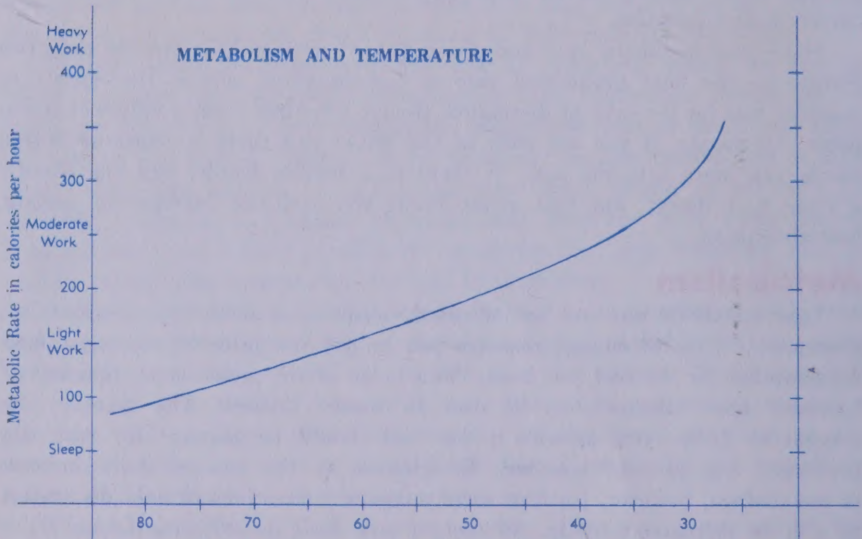
Metabolism

Your metabolic rate can be increased considerably more than your radiant absorption. This, of course, requires you to pay the price of increased food consumption for the fuel you burn. Man in an arctic environment does indeed consume more calories than he does in warm climates. The increase can amount to 2,000 extra calories a day and should be planned for with any prolonged trip in cold weather. In addition to the general daily increase in metabolism, however, you can solve temporary situations of cold discomfort by a little increased activity. In fact, if you don't do it yourself, your body will do this for you by shivering.

Muscular activity can increase your metabolic rate by as much as 750% for short periods, and we are all familiar with running around or stamping our feet to keep warm. However, shivering and muscular tension exercises have two advantages over running around or performing some sort of work. With outside work, only part of the energy ends up as body heat; and the heat of the work performed is lost to the environment. With shivering or muscular tension exercises, where you simply strain one muscle against another, almost all of the heat is immediately available to your body. Secondly, they are something you can do in a sleeping bag or sitting on a cold chairlift. At least 10 minutes exercise is needed to produce results.



Another way to increase metabolism when you go to bed is to eat a candy bar. The digestive process will help to warm you up. Also, if your clothes are not wet, try getting undressed inside the sleeping bag. By the time you get your pants and socks off inside a close fitting mummy bag, you will have worked up quite a head of steam and be off to a good warm night's sleep. One other hint for a warm sleep is to keep yourself warm *before* you go to bed. Put on your spare clothing when you stop for the day. Don't get thoroughly chilled by standing around and then expect your sleeping bag to warm you up after vaso-constriction has started. Following is a graph showing the effect of metabolism on your heat balance.



Temperature in °F at which an unclothed man could maintain a heat steady state.

Involuntary Adjustments

On the heat loss side of the equation, there are several things your body does automatically over which you have no direct control. First there is sweating; but since this increases heat loss and we are considering how to reduce excessive heat loss, we will say that you can control sweating by simply seeing that all heat is lost through some of the numerous other channels. If you sweat now you will be cold later, so *don't sweat.* The other involuntary reactions are goose pimples, which erect the body hairs and increase the thickness of still air next to the skin, and vaso-constriction.

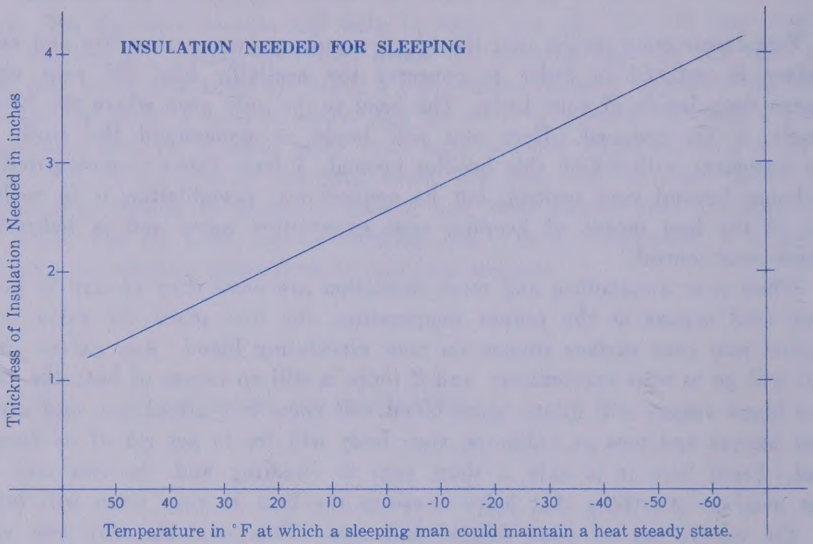
Vaso-constriction means that the blood supply to your extremities and skin surface is reduced in order to conserve the available heat for your vital organs deep inside of your body. The head is the only area where the blood supply is not reduced. Here you will begin to understand the truth of the statement with which this booklet opened. I have listed vaso-constriction as being beyond your control, but its counterpart, vaso-dilation is in reality one of the best means of keeping your extremities warm and is indirectly within your control.

When your metabolism and torso insulation are more than enough to keep your vital organs at the proper temperature, the first place the extra heat goes is into your surface tissues via your circulating blood. Any excess after that will go to your extremities; and if there is still an excess of heat, the surface blood vessels will dilate, more blood will come into circulation and using your fingers and toes as radiators, your body will try to get rid of its excess heat. From here it is only a short step to sweating and the two may in fact overlap. Anything that helps conserve the heat in your torso will force all the excess out of your fingers and toes. This explains why you can sometime chop wood in bare hands at 10°F below zero, and at other times your hands are cold skiing at 10°F above zero. It also means that warm boots and mittens will not keep you warm if your general torso heat balance is marginal. Poor body heat, along with cool skin temperature at fingers or toes will trigger the vaso-constriction reaction and shut down the blood supply to your extremities. Nicotine also has this effect, so if your hands are cold, don't smoke. Once the circulation is shut down, frostbite can follow quickly.

Because the head has such a rich blood supply and no vaso-constriction mechanism, it is the primary radiator for excess body heat. Therefore, if you want to force that heat to your fingers or toes, you must make sure it isn't lost through the head. A parka hood, incidentally, is much better than a hat because it keeps the breezes from blowing down your neck. Now you know why you put your hat on if your feet are cold.

Insulation

We now come to the most important means of reducing heat loss and keeping our heat equation in balance; man's private environment which he holds closely around himself by his clothing. This clothing attempts to insulate the warm body from the cold environment and hence prevent the passage of heat. As we have shown, insulation depends on thickness. The colder the environment the thicker the insulation needed. For a sleeping or inactive man, the following graph shows how the required thickness increases with a decrease in temperature.



In practice, the only garment that approaches this thickness uniformly is a close fitting mummy shaped sleeping bag. If this is of proper construction with no stitched-through cold seams and you sleep on a pad that will retain the necessary thickness under body pressure points, you will have a uniform covering of the desired thickness except for the face. Most clothing, on the other hand, is a collection of compromises. Hands and face are often bare, feet have a minimum thickness, legs not much more, and the torso usually has a greater thickness of insulation than would be required by a uniform covering over the whole body.

There are two things which affect the effectiveness of clothing insulation: wind and moisture. We have shown how insulation depends on a given thickness of dead air; but if there is a high wind blowing, not only will the heat from the outer layer of your clothing be carried away faster, but the wind can penetrate your insulation, thus destroying the dead air and cutting your insulation by as much as 50%. Your insulating layer must be protected from wind penetration by an outer layer of wind resistant material. The effect of wind on the bare face is, of course, well known; and this often becomes the limiting factor even though the rest of the body is well clothed.

Moisture inside the insulation not only sets up the heat-removing cycle of evaporation, condensation and re-evaporation already mentioned but actually destroys the loft or thickness of most clothing insulations. The open cell

foams retain their thickness when wet but soak up the water in place of the original dead air and lose their efficiency that way. Closed cell foams have some application because moisture cannot penetrate (skin diving wet suits and flotation jackets are examples), but they do not allow body moisture to pass through and are rather stiff in any effective thickness. Materials like down, dacron batting, wool and especially cotton tend to mat down when wet and lose most of their original thickness. When the temperature outside is below freezing, the 1½ pints of moisture the body generates each day will condense and sometimes freeze in the outer layers of clothing or sleeping bag. After several days without opportunity to dry out, this becomes a major reason for loss of insulation.

Six Basic Rules

Enough of theory. If you have digested everything so far you are probably impatient for a few practical suggestions to help you keep warm. It matters not why you need to keep warm—waiting for your bus on a cold snowy street corner, skiing, watching a football game, or climbing in the Himalayas—the principles are the same; and you can apply some or all, depending on the urgency of your situation. Here are half a dozen cardinal rules to comfort:

1. Remember—*Thickness* is warmth. It is the *thickness* of insulation used that counts not the material it is made of.

2. Keep your torso warm so it can send its excess heat to your less well insulated extremities.

3. Avoid sweating by ventilating to bypass your insulation before you start to sweat.

4. Keep wind and rain out of your insulation by suitable outer covering or protection.

5. Use your head. Keep it covered to help force heat to your extremities. Uncover it early to avoid sweating.

6. Increase your metabolism by straining one muscle against another if you are all buttoned up and still cold.

The Science of Clothing

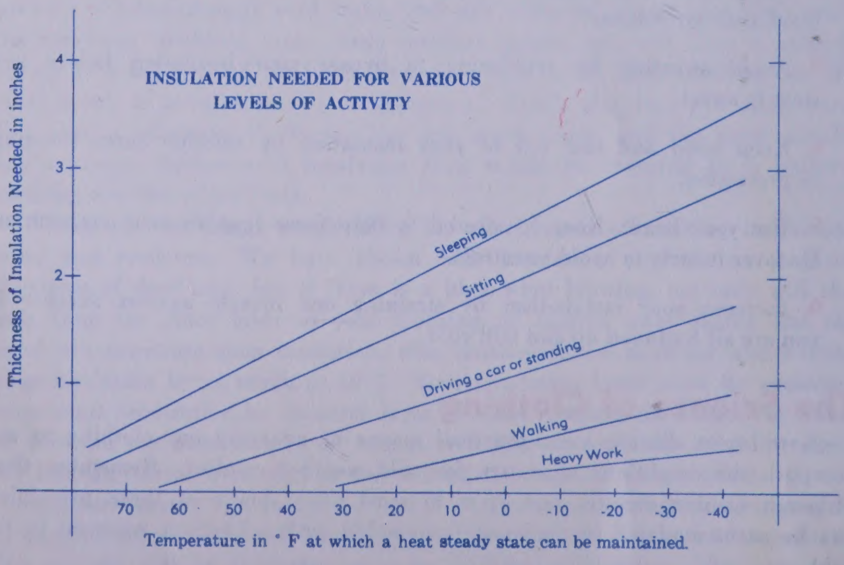
Now let us discuss some practical means of adapting our clothing to accomplish the conditions necessary for cold weather comfort. Remember that although fashion dictates our dress in most cases, many of these principles can be accommodated in the most fashionable outfit. There is no need to be cold.

Ventilation

Starting with the skin and the need to prevent body moisture from entering the clothing, the requirement is for an air space around the body so the moisture can evaporate and the vapor laden air can then move freely out the neck opening. It will not force itself through the clothing if it is free to leave by an easier method. The many brands of ventilating net underwear are the answer to the problem. They even make an ordinary suit of clothes feel better in winter. The proper type is distinguished by a 3/8" square mesh or larger, about 1/8" in thickness and completely open. Smaller holes and "waffle weave" underwear simply do not allow the necessary evaporation to take place. So called "insulated underwear" should not be worn next to the skin except for short periods. It can be used as effective insulation when worn over ventilating underwear if great thickness is not required. Start out right by keeping body moisture out of your clothing. Wear ventilating net underwear.

Insulating Thickness

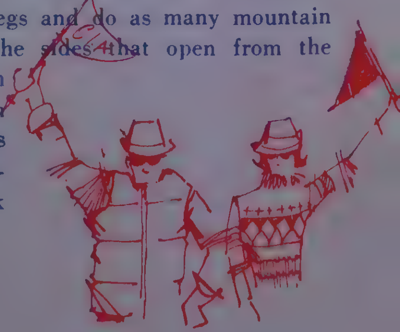
Next comes your insulating layer. For practical reasons, we usually start with a conventional shirt and trousers. These can be counted on for an effective 1/4" of insulation if they are a wool shirt and heavy trousers. An ordinary business suit gives about the same. To this must be added sufficient insulation to give an average effective thickness according to the temperature and your metabolic rate. The following graph will give you an idea of the average thickness you should aim for at various activity levels.



This graph is based on the assumption that your activity, hence your metabolic rate, will be constant and the average thickness of insulation is planned to allow just the proper amount of heat to be lost through the insulation . If you are going to be doing intermittent heavy work with periods of resting, the same insulation will not serve both. Nor can you use an average thickness for both because this would immediately mean you would be too warm for the activity and hence sweat, and this would make you much too cold for the periods of resting because your clothing would be damp. The only answer to differing rates of activity is adjustable insulation. There are two way to adjust: one is to peel layers off during activity and put them back on during rest. This is not only time consuming but in many situations it is impractical, such as riding a cold windy chairlift, then strenuously skiing down in the hot sun, or hiking with a heavy pack and resting in an exposed location. With properly designed clothing and the use of ventilating net underwear, it is possible to leave your maximum insulation on at all times and ventilate the excess heat out from inside it.

It has been pointed out that different parts of the body react differently to the stress of cold and so it is with their cooling ability. When you are wearing too much insulation and you want to reduce it by ventilation, it is only sensible to start with the most efficient heat radiators you have. Your head tops the list. Uncover it first. Then open your neck and shirt front. This lets most of the heat out from around your torso. A zipper that opens from both top and bottom is a great aid here. The wrists and hands are next in importance. Not only do the veins run close to the surface on the under side of the wrists, thus making them excellent radiators in themselves, but by allowing air to enter at the wrists and move up the arms, it cools one of the greatest sweat producing areas of the body, the axilla.

The last source of ventilation is the cuffs at your pants. In deep snow this becomes impractical; and in an effort to increase heat loss below the belt, which generally isolates the legs from any ventilation system for the torso, one usually leaves them very lightly insulated. For most conditions this will work although it contributes to cold feet by causing too great a drop in temperature as the blood travels along the exposed pipe line from torso to feet. It would be much better to insulate the legs and do as many mountain climbers do: Arrange ventilating zippers on the sides that open from the waist down so large areas above the snow depth can be opened when needed. When this system is used, it is often found that ventilating the legs is the most convenient method of cooling the entire body, better even than leaving head and neck exposed.



It should be realized that efficient ventilation in this manner requires not only that ventilating net underwear be worn but also that the other layers of clothing are loose so the natural bellows action of the clothing in movement can pump lots of air freely through the layers. One very important side advantage of this method of clothing is that it automatically gets rid of the half pint of insensible perspiration produced every 8 hours.

The corollary to providing for adequate ventilation for cooling is, of course, the ability to close pants cuffs, wrists, neck and head openings air tight as soon as heat conservation is necessary.

Why Goose Down

We have gone to some lengths to explain why insulation depends on the thickness of dead air provided; not on the material used to deaden it. However, from a practical clothing application, there is one material that is better than all others and this is DOWN. The quality of down is judged on 3 factors: (1) The number of cubic inches an ounce will fill using Federal Standard 148(a). Prime quality runs at least 500 cubic inches and sometimes as high as 650. (2) Its compressibility and resiliency, or how small it will compress under hand pressure of about 4 lbs./sq. ft. and then how much of its original volume it will recover immediately upon release. (3) Its durability, or how long it will go through the compression/release cycle without permanently losing some of its original loft. It used to be that down could be classed by bird and color and its performance depended upon. Now the down market has grown so that processing techniques and even growing techniques are being developed to increase the performance of what used to be the lower grades of down. Today, performance of the actual product is the only way to be certain of a high quality insulation. Down still retains these advantages over any other insulation.

1. It is light weight—it takes only an ounce to insulate about 600 cubic inches. Down gives warmth without weight.

2. It compresses very easily—the same ounce that fills 600 cubic inches will compress under hand pressure to only 15 cubic inches. Not only do thick, warm sleeping bags compress to backpacking size but clothing becomes super warm and super comfortable. Two inches of down in a nylon shell is no more cumbersome than a knit sweater.

3. Down breathes—the natural bellows action of clothing keeps the down dry much longer than any other insulating materials. It lets the body moisture escape freely.

4. Down is resilient—it survives many compression release cycles, each time coming back to its full thickness. Other materials fatigue quickly and lose their thickness.
5. Down is washable—in properly constructed garments and sleeping bags, the down should be washed to keep it clean and fluffy.

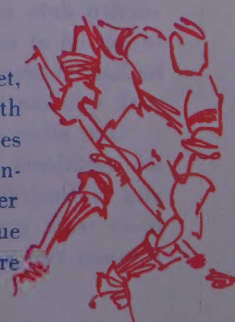
The choice of fabrics to contain the insulation plays some small part in your comfort also. Very thin nylons, although cold to the touch due to their good conductivity, have a very low heat capacity. They quickly warm up and actually absorb less heat from your body than does cotton flannel which feels warm the instant you touch it but has a much larger capacity to absorb heat from your body. Nylon is also slippery, and this means less restriction in thick garments and less chance of getting bound up inside a sleeping bag.

Outer Shell Protection

Once you have donned sufficient thickness of insulation to prevent excessive heat loss, there is only one more requirement. The insulation must be protected from wind and rain penetration from outside. It is not practical to try to combine both wind protection and rain protection to the same garment although attempts to do so are continually being made and hopefully will bring eventual success. The objections to doing both with a single material are that if it breathes enough to prevent condensation of body moisture inside, it will probably leak in a prolonged rain. If it is plastic coated so no water can pass through, it can condense so heavily on the inside that you will be convinced the rain is coming right through the coating. A water repellent, very tightly woven 5 oz. cotton fabric can be an excellent compromise. I personally prefer to spend the same weight by carrying a wind parka of 2½ oz. nylon fabric and a separate plastic coated nylon poncho also of 2½ oz. fabric. The parka gives the proper closure and ventilating possibilities in dry cold, and the poncho provides much more ventilation so it doesn't condense as badly in a cold rain. This outer shell protection completes your clothing assembly.

Hand Protection

Let us close with a few specific words about hand and feet, often our greatest problem areas. Any engineer is familiar with the paradoxical effect of curvature when adding insulation to pipes of very small diameter. The first layers of insulation actually increase the heat loss because the radiating surface increases faster than the insulation. This same phenomenon unfortunately is true of fingers; and until you reach ¼" of thickness, you are doing more



harm than good if the gloves fit tightly. Ordinary gloves, even foam insulated ski gloves, are not very efficient insulation. Most are made with straight cut fingers, which, when curved around a ski pole, stretch tightly over the knuckles and just where you need thickness you have thin spots.

By considering the fingers together as a unit, you eliminate the small diameter effect and insulate their warmth collectively. This makes mittens much more effective than gloves. Naturally, one likes the dexterity of gloves; and they will suffice most of the time, especially, if the other methods of keeping yourself warm are put to good use. However, a pair of mittens in the pocket for emergencies can prolong the comfort span. An especially warm mitten can be made with the back insulated like a boxing glove with the fingers curved in grip shape, since the hand is most often used in this position.

If ordinary windproof shell ski mitts are used with woolen liners, carry spare dry liners next to your body to change into when the first set becomes wet and cold. To handle cameras and ski bindings comfortably, try a pair of thin knit nylon gloves under your insulation. Keep these on when you touch the bare metal. Once fingers get gold and defy all attempt to warm them, take your mittens off, withdraw your arms from your sleeves inside your insulating garments, and tuck your hands under opposite arm pits. If you have proper body insulation, this will give your hands a new lease on life.

Foot Protection

Your feet are usually under the pressure of your body weight; they are good sweat producers; they are farthest from your body heat source; and if there is any moisture around, they are usually standing in it. Is it any wonder that they are often cold? Good heavy wool socks that resist compression, inside good leather boots that reduce condensation to a minimum, and the addition of plastic mesh insoles that allow ventilation under the soles of the feet are the best combination for most purposes. Felt insoles will actually give more insulation than mesh insoles, but a dry pair must be carried because once loaded with moisture, they become excellent conductors of heat. A dry pair of socks carried next to your body is an excellent emergency provision and pleasure to put on at night if you are on an overnight trip. Your leather boots should be kept waterproof with a wax type compound like Sno-Seal. Greases and oils soak into the leather and reduce its natural insulating properties.

One other excellent method of keeping your feet warm is available but its usefulness is somewhat limited. It is called the double vapor barrier and is ideal for duck hunters, ice fishermen, vehicle drivers, and others who don't walk great distances. This consists simply of encasing the insulation between two vapor barriers so it stays dry and fluffy, protected from outside

moisture on the one hand and condensation of body moisture on the other. Commercially these boots are variously known as "Korean Boots" or "Thermo Boots," etc. To be effective, both outer and inner boot must be of rubber coated material or the insulation must be of closed cell foam. The insulation must be at least ¼" thick. You can achieve the same results with two thin plastic bags and ordinary wool socks and leather boots. One plastic bag goes on next to your skin, then your socks (at least 2 pair of heavy wool) and a felt insole, then the other plastic bag and finally your boot. Some people don't like the feel of the accumulated moisture inside the inner vapor barrier, but this is the proof of the amount of moisture that would otherwise have gone into your socks to rob them of their insulating value.

With today's knowledge of materials and physiology, there is no reason not to enjoy the outdoors in winter as well as summer nor is there any reason to be miserably cold watching a football game. Increase your enjoyment by observing these few simple rules:

1. Remember—thickness is warmth.
2. Keep your torso warm—it will heat your toes and fingers.
3. Avoid sweating—ventilate first.
4. Keep out the wind and rain—use a suitable outer shell.
5. Use your head—cover it when cold, uncover to avoid sweating.
6. Increase your metabolism—indian wrestle with yourself.

Don't Forget—Gerry manufactures a complete line of clothing and equipment for cold weather comfort.

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